Fasting and Honesty

Experimental Evidence from Egypt

Dina Rabie[*]   Mohamed Rashwan[†]   Rania Miniesy[‡]

Abstract

This paper examines the effect of religious fasting on truth-telling using a laboratory experiment in Egypt. While fasting-induced religiosity may promote truth-telling, the physiological and psychological changes during fasting, due to alimentary abstention and self-control exertion, may reduce honesty, especially when fasting is augmented with effort. We examine this question by tracing individual truth-telling decisions, in the absence and presence of additional effort, both before and during Ramadan. We find that neither effort nor fasting alone affects honesty, but exerting effort while fasting reduces honesty. We provide suggestive evidence on the mechanisms potentially driving this negative effect on honesty.

Keywords: honesty, fasting, real effort, religiosity, self-control

JEL Classification: C91, D01, Z10, Z12

Abbreviations: none

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[*]Corresponding author. Department of Economics, Northeastern University London, London, United Kingdom. Email: d.rabie@northeastern.edu.

[†]Department of Business Administration, The British University in Egypt, Cairo, Egypt.

[‡]Department of Economics, The British University in Egypt, Cairo, Egypt.

1 Introduction

Fasting is a required practice in various religious beliefs including Islam, Christianity, Judaism, and Hinduism. Individuals who adhere to religious fasting are typically faced with real-life economic decisions that involve truth-telling or honesty. Examples include tax-reporting, declaring imported goods for customs, and job applications, among others. Fasting individuals are also often faced with situations that require exerting (additional) effort, mental or physical, such as carrying out an effort-intensive task during work, or queuing up for long before reaching an airport's customs point. This raises the question of whether religious fasting induces individuals to act honestly, and whether this effect, if any, is altered when fasting individuals are faced with effort-intensive tasks.

Conceptually, religious fasting may have two countervailing effects on honesty. On the one hand, religious fasting can induce higher religiosity, or a stronger moral identity, among individuals encouraging them to avoid sinful behavior, such as lying. Indeed, honesty has been found to be highly correlated with religiosity in non-experimental settings (Aghababaei, 2012; Grasmick, Bursik, and Cochran, 1991; Lee et al., 2005; Saroglou et al., 2005; Silvia et al., 2014).[1] A number of experimental studies found that honesty increases when individuals are primed with religiosity (e.g., Aveyard, 2014; Randolph-Seng and Nielsen, 2007). On the other hand, religious fasting has physiological and psychological implications that may reduce honesty. The alimentary abstention resulting from fasting reduces the glucose level in the blood (Fazel, 1998), which may negatively affect concentration and prosocial behavior (Gailliot and Baumeister, 2017; Gailliot et al., 2007), including honesty. Furthermore, religious fasting usually imposes other restrictions beyond alimentary abstention, such as abstaining from smoking and sexual activities, observing additional prayers, and following a prosocial attitude. While adhering to these restrictions can promote self-control in the long-run (Seeley and Gardner, 2003; Muraven, Tice and Baumeister, 1998), it can also reduce self-control ability in the short-run, leading to lower honesty. These physiological and psychological implications can be further exacerbated by the exposure to effort-intensive tasks.

This paper examines the effect of religious fasting during Ramadan on honesty, both in the presence and absence of an effort-intensive task, using a laboratory experiment

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1. This positive relationship does not hold universally, though. For example, Guttman (1984) found that religiosity is negatively correlated with honesty.

in Egypt.[2] We randomly allocate the experimental subjects to one of two groups. One group plays an honesty game after an intensive real effort task. We refer to this group as Effort First (EF). The other group plays the honesty game first followed by the effort task, and we thus refer to this group as Honesty First (HF). Each individual participates in our experiment twice, both before and during Ramadan. In the honesty game, each subject privately draws a number from a cup containing a set of symmetrically known numbers. In a second step, the subject privately reports to the experimenter the number drawn according to which the reward is determined. We define dishonesty as reporting a number higher than drawn, in order to increase one's payoff. Although the design keeps the identity of the subject anonymous, it allows us to ex-post verify if a given subject has lied or not. For the real effort task, we adopt Azar (2019)'s Finding Letters on Pages task, where we set a time limit (20 minutes for 40 tasks), in order to trigger frustration and fatigue among participants. We tie the payoff from the effort task to performance, in order to ensure participants' engagement in the task.

This experimental design allows us to make three empirical comparisons. First, we conduct a cross-sectional analysis where we compare the proportion of liars between the EF and HF groups before Ramadan. This measures the effect of the real effort task on honesty in the absence of fasting. Second, we exploit the panel structure of our data, to compare the proportion of liars within the HF group before and during Ramadan. This captures the effect of fasting on honesty, in the absence of the effort task. Third, we employ a difference-in-differences (DiD) strategy that compares the evolution between the two rounds in the proportion of liars across the two groups. We control for individual fixed effects that account for any (time-invariant) unobserved heterogeneity across individuals in the propensity of lying. Alternatively, we also examine the relationship in a random effects framework where we control for individual observed characteristics. This DiD strategy captures the combined effect of fasting and the effort task.

Our cross-sectional analysis does not show any statistically significant effect of effort on honesty before Ramadan. Furthermore, the proportion of liars within the HF group is not statistically different before and during Ramadan, suggesting that fasting alone does not affect honesty. This could be because the religiosity and physiological and

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2. Ramadan is the ninth month in the Islamic lunar calendar. Fasting during Ramadan is a major requirement for Muslims and one of the five pillars of Islam, that is intertwined with honesty from the viewpoint of Muslim jurists. Muhammad, the prophet of Islam, said, "if one does not eschew lies and false conduct, Allah has no need that he should abstain from his food and his drink."

psychological implications of fasting may have offset each other, resulting in an overall null effect. Nonetheless, we find that the proportion of liars within the EF group increased significantly during Ramadan. This implies that when the physiological and psychological effects of fasting are augmented with intensive effort, honesty decreases.

While our experimental design does not allow us to empirically identify the mechanisms of this effect, we employ the participants' self-reports in the post-experiment questionnaire during Ramadan, to provide suggestive evidence on some of the potential mechanisms. Specifically, we examine whether the combined effect of fasting and effort varies by (proxies for) fasting-induced religiosity, alimentary abstention, and psychological changes such as ego depletion. Our evidence does not support that the negative effect of fasting and effort is explained by religiosity or alimentary abstention. However, we find suggestive evidence that ego depletion is a plausible mechanism of the increased lying within the EF group during Ramadan. That said, we are not able to confirm or refute other potential mechanisms, including moral licensing, or a heightened feeling of entitlement, among the EF group during Ramadan.

The main contribution of this paper is to experimentally demonstrate that performing an effort-intensive task while fasting, can increase dishonesty. This finding has important implications for employers and governments in Muslim-majority countries, where fasting during Ramadan is commonplace. Specifically, employers should ration the effort-intensive tasks that are assigned to fasting employees, or give more flexible working hours to these employees. Governments should also take this into account when requesting certain public duties from their fasting citizens that require truth-telling, including voting or tax reporting. For example, these duties should not be coupled with exerting intensive effort, such as queuing in long lines to vote, or filling out long forms to declare their taxes.

This paper is organized as follows. Section 2 describes our contribution to the literature. Section 3 discusses the experimental design and procedures. Section 4 describes the data. Section 5 presents the empirical analysis and findings. Section 6 discusses various potential mechanisms and section 7 concludes.

2 Related Literature

This paper speaks to different strands of literature. First, many experimental studies have documented a positive relationship between religious priming and honesty.[3] For example, Randolph-Seng and Nielsen (2007) showed that students in the United States of America primed with religious words (the supraliminal sentence unscrambling task) were less dishonest than those who were primed with sports-related or neutral words.[4] Aveyard (2014) examined the same relationship but in the United Arab Emirates through employing a supraliminal sentence-unscrambling task, using religious words, and a naturalistic religious priming (listening to the Islamic call for prayer "*athan*") treatments. For the religious words treatment, Aveyard observed similar rates of honesty between the participants who were primed with religious words and those who were primed with non-religious words, while honesty rates were higher for participants who heard the *athan* compared to those who did not hear the *athan*.[5] This observation suggests that verbal religious priming might not be relevant in Muslim-majority countries where their everyday language is loaded with religious verbiage. Ramadan thus provides an interesting environment to examine the effect of religiosity on truth-telling. We contribute to this growing literature by examining the effects of Ramadan fasting on honesty.[6]

In addition to the religiosity effects that may be brought by Ramadan observance, fasting also results in physiological and/or psychological changes due to alimentary abstention and possibly negative self-control exertion after effects in the short-run (Banfield et al., 2004; Baumeister et al., 2007; Karaagaoglu and Yucecan, 2000; Muraven, Tice and Baumeister, 1998; Schmeichel, Vohs, and Baumeister, 2003). Fasting during Ramadan entails the abstention from all kinds of food and drinks, including water, from dawn to dusk for the whole month. This alimentary abstention could result in low glucose levels in the blood, which in turn may negatively affect concentration levels and social behavior (Gailliot et al., 2007; Fazel, 1998). Alimentary abstention also involves the exertion of self-control to adhere with this strict dieting. Studies show that strict dieting

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3. See Hoffmann (2013) for a discussion on the inclusion of religion in experimental economics.

4. This task involves unscrambling a group of words to form a sensible sentence.

5. The athan was also used by Duhaime (2015) to test for the effect of this naturalistic religious prime on altruistic behavior of male shopkeepers in Marrakesh, Morocco. Shopkeepers expressed increased altruism/prosocial behavior when the athan was audible than when it was not.

6. Haruvy, Ioannou and Golshirazi (2018) showed that giving (in dictator games) is higher during the window of Ramadan fasting than during the window of non-Ramadan fasting.

reduces the self-control ability to fulfil another goal such as quitting smoking (Shmueli and Prochaska, 2009; Cheskin et al., 2005; Hall et al., 1992). These physiological and psychological consequences of fasting could increase dishonesty.

In fact, the implications of applying self-control in the short-run have attracted the attention of a large and growing number of studies. Theoretically, Baumeister et al. (1998) advanced two models to explain the changes in self-control ability after use. In the "knowledge structure" model, the exercise of self-control enables a "switch" leading to better ability to control oneself in subsequent tasks (Baumeister et al., 1998). The "resource" model, on the other hand, regards self-control as a limited resource that becomes depleted in the short-run with use (Baumeister et al., 1998; Baumeister and Vohs, 2018).[7] In contrast, the "process" model postulates that self-control exertion results in a shift in individuals' motivation towards increased feelings of entitlement and heightened reward-seeking tendencies (Inzlicht and Schmeichel, 2012; Kelley, Finely and Schmeichel, 2019).

Empirically, there is ample evidence on self-control exertion after effects (Baumeister, Vohs and Tice, 2007; Mead et al., 2009; Gino et al., 2011; Dang, 2016; Baumeister and Vohs, 2018; Kelley, Finely and Schmeichel, 2019). However, the interpretation of those effects in relation to the theoretical models is far from consensual with the ego depletion being the most common and, lately, the most controversial. Specifically, recent replication studies challenged the ego depletion effect sizes. For example, one meta-analysis of 198 published experiments by Hagger et al. (2010) asserted the existence of medium to large ego depletion effects. Carter et al. (2015) extended the meta-analysis to unpublished research and observed signals of small-study effects owing partly to publication biases. After correcting for such effects, they declared that the depletion effect is "not robust to context" and is "indistinguishable from zero", thus concluding that there is "very little evidence that the depletion effect is a real phenomenon". Furthermore, Hagger et al. (2016) conducted a multi-lab registered replication that involved more than two thousand participants from twenty-three laboratories worldwide and found almost zero effect and thus no evidence of ego depletion.

Dang and Hagger (2019) returned the big heterogeneity in the ego depletion effect size across studies to the lack of sufficient controls over the variability in effort and fatigue

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7. Baumeister et al. (1998) resembled self-control by a muscle that gets trained and becomes exhausted after excessive training. Their work on self-control became thus known as the "strength model".

levels of participants, which affects their full engagement in the depleting task, and in the variation in the participants' real-time responses to a demanding task that usually lasts a brief period. They also pointed out that some tasks might be exciting to subjects that they result in a "warm-up" of their self-control ability. To overcome the variability in compliance across an experiment's subjects, Palma et al. (2018) used biometric measures to accurately estimate the after effects of self-control exertion in low and high self-control demanding tasks. Their findings, supported with a theoretical framework, show that at low levels of self-control exertion self-control ability increases in line with the knowledge structure model. Yet, at high levels of self-control exertion, exceeding a certain threshold, ego depletion occurs as predicted by the resource model (Palma et al., 2018). Their finding is in line with Vohs, Baumeister and Schmeichel (2012)'s that multiple tasks increases the magnitude of ego depletion. Ego depletion is also found to be smoothed out by promoting high moral identity (Gino et al., 2011), possibly reducing its effect size. While our experimental design does not directly test ego depletion, it is one of the potential mechanisms of the effect of fasting and effort on honesty. Specifically, Ramadan fasting may smooth the negative effects of ego depletion and alimentary abstention on honesty through spirituality.

3   Experiment Design

Inspired by Fischbacher and Föllmi-Heusi (2013)'s die rolling game, we design a paper-and-pen experiment where we can (ex-post) observe individual (dis)honesty without losing anonymity, as will be explained below. Furthermore, we examine how preferences for honesty may change after an independent real effort task. The honesty game and the real effort task in our experiment are designed to provide an easy-to-understand way to maximize one's payouts, regardless of subjects' cognitive ability or educational level.

3.1   Experiment Protocol

Before introducing the tasks, we set a procedure to follow the choices of the same subject. Specifically, at the beginning of each experimental session, every subject randomly receives an A4-size envelope in which there are two identical small letter envelopes. On the internal side of all three envelopes, a unique code (i.e. subject anonymous ID) is

written. The code is also written on a separate paper slip placed inside the A4 envelope for the subjects to keep for participation in the second round.[8] The codes were random and there was no way for us to link a subject's code with his/her identity. Identity checks and payouts were made in a separate room.

Honesty Game. Our honesty game employs a cup and six folded paper clips; referred to hereafter as the Papers-in-Cup Game (PCG).[9] The PCG starts with identical cups placed on a table in the experiment room/laboratory. Each cup contains six folded paper clips on which a number from one to six is written. To establish trust, a volunteer subject is randomly selected to check a random cup of his/her choice, unfold the paper clips and read out loud all the numbers. Next, each subject picks a cup, blindly draws a single folded clip, privately reads it, and then puts it in a letter envelope (as explained above) and seals it. The letter envelopes are then deposited in a box located in the middle of the room.[10]

Subjects are then asked to report the number drawn on another piece of paper that is placed on their desks. Before reporting though, the experimenter reads aloud the payoff structure part of the instructions sheet given to subjects at the beginning of the game to emphasize the incentives given to report higher than drawn. Specifically, the experimenter announces that if the number reported is 1, the subject's payout is 5 Egyptian Pounds (around €0.25).[11] If the subject reported 2, the payout is EGP 10. That is, the payout keeps increasing with the reported number in steps of EGP 5 until the highest payout-maximizing number 6 that is associated with a payout of EGP 30.[12] Subjects are then given payment slips according to the number reported, to be cashed out at the end of the session, and then asked to put the reported number in another envelope, seal it, and put it also in the box in the middle of the room. This way the experimenter is able to match the drawn and reported numbers by every subject via the codes on the envelopes,

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8. At the beginning of every session, subjects are asked to check the envelopes and the paper slip, and verify that the code is identical on all envelopes. This is to make sure all subjects are aware that we are giving them codes that de-facto replaces their identities.

9. This terminology is inspired by Shalvi et al. (2011)'s die-under-cup game.

10. We are not the first to use folded papers and envelopes in an honesty game. Gneezy, Kajackaite, and Sobel (2018) used similar procedures in their non-observed honesty task. We add subject-specific codes and therefore we can ex-post match the drawn and the reported numbers through the codes.

11. At the time of the experiment, the exchange rate was €1 = EGP 20.

12. Unlike in Fischbacher and Föllmi-Heusi (2013), the draw of number 6 does not lead to zero payments because we do observe individual behavior and therefore can directly obtain the percentage of honest individuals. Furthermore, we do not want subjects to leave the lab with zero payouts for this game.

while keeping the identity of the subject unidentifiable by the experimenter because the payouts are administered in a separate room.[13] The PCG instructions are presented in Appendix A.

Real Effort Task. We adopt Azar (2019)'s "Finding Letters on Pages (FLP)" task to induce real effort. In this task, subjects are given nine pages on which continuous series of English alphabet letters are written. Subjects are required to respond to 40 tasks of counting pages, lines and letters to find what letter is written in a specified position on a specified page. The font size decreases as the game progresses from one page to another (font size 24 on page 1 to font size 10 on page 9) which increases the required counting to find the correct letter. We present our instructions for this task in Appendix B.

Subjects are informed, before starting the task, that their answer sheets will be corrected and they will be paid for every successfully found letter an amount of EGP 2 (equivalent to €0.10). Furthermore, we set a time limit of 20 minutes to find the 40 letters. The increase in the required effort under a time constraint together with the repetitiveness of the task and the relatively low reward for every successfully accomplished task are meant to induce frustration and boredom, and to stimulate exhaustion. We, however, give the subjects the option to stop after the 10th task while still being eligible for a payout to account for any eyesight problems and to check if the subject thinks the payoff is too little compared to the effort required. However, none of the subjects used this option in our experiment.

The task is administered in paper-pen format. Subjects are asked to write their codes on the top of their answer sheet. At the end of the 20 minutes, the experimenter collects the answer sheets to be corrected.[14] Subjects receive the corrected answer sheets back and the corresponding payment slip for this task at the end of the session. Subjects are asked to deposit the answer sheet into the A4 envelope they have and to keep the payment slip to be cashed out.

3.2 Experiment Treatments

To address our research question, we randomly allocate subjects to one of two groups:

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13. This way we minimize any potential social identity concerns with respect to lying.

14. A lab assistant corrected the subjects' answer sheets while the experimental session was running.

Honesty First (HF). In this group, subjects play the honesty game (PCG) succeeded by the real effort task (FLP). For this group, subjects' decision to lie is not affected by a preceding task and thus preferences towards honesty can be directly elicited by subjects' decision to report a number that is equal or higher than drawn.

Effort First (EF). In this group, subjects first play the real effort task for 20 minutes before they play the honesty game. Subjects, however, were not given feedback on their performance in the FLP task until the end of the session. Therefore, subjects are affected by the effort but not the financial reward of their effort. However, they may still have high expectations on how well they performed in the task. While we did not elicit beliefs on performance, we expect the effort to dominate any possible wealth effect since this task is low paying relative to the effort required.

Experiment Rounds. The experiment consists of two rounds. In April 2019, invitations to participate in an one-hour experiment on decision-making were sent to all students and employees, including academic, administrative and blue-collar workers, of The British University in Egypt (BUE).

1. **Before Ramadan (BR)**. The first round of the experiment took place in April 2019; three weeks before Ramadan. Subjects who were randomly allocated into the HF and EF groups played the two tasks in the order defined by their group, then responded to a short questionnaire on their socio-economic characteristics.[15] Finally, they were asked to put the questionnaire inside the A4 envelope they have on which the individual code was written. Every subject received his/her payouts for this round right after the experimental session, in private and in a separate room as explained above.

   At the beginning of every session, subjects were informed that they will be invited to participate in one more session and will receive, in addition to their payouts, EGP 50 (around €2.5) as a participation fee upon showing up for the later session. Subjects were asked to privately keep their individual-participation codes to be able to participate in the later session and receive the participation fee.

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15. The questionnaire also included open questions on subjects opinions on the tasks and noise questions on weight and height.

2. **During Ramadan (DR)**. The second round took place in the following May, during the second week of Ramadan. We decided that the second week of Ramadan is optimal because of two reasons. (a) The first week of Ramadan usually involves a lot of family gatherings resulting in many individuals taking leaves during this week. (b) Muslims get used to fasting and thus the exhaustion from alimentary abstention decreases gradually over the course of the month. Therefore, we chose the second week of Ramadan to guarantee employees and students regular attendance on campus while participating individuals are not yet totally used to fasting.

   Subjects were invited by e-mail to return to the lab and join one more session to receive their participation fee - together with the new payout. Subjects were offered sessions that guarantee they will be joining the same EF/HF group, and at the same time of the day (morning vs. afternoon) as that of the session they joined in the first round (BR). Subjects participated in the same tasks as in BR but were not informed at any point about the content of the tasks prior to joining their session until they faced the respective task. Right after the experiment, subjects were asked to fill in a questionnaire about their eating and drinking habits, and any religious services they carry out. They then privately received their DR payouts along with their participation fee.

4 Data

4.1 Subjects, Attrition and Randomization

Before Ramadan, 167 employees and students at a private university in Egypt (BUE) participated in the experiment. To verify the validity of the randomization across the HF and EF groups in the BR and DR rounds, we present the characteristics of subjects first by attrition and then by group.

During Ramadan, 72.5% of the subjects (n=121) returned to the lab to take part in the experiment. Two notes are in order here: (1) when we made the invitations for the BR round, we did not announce that there will be an additional round one month later, and (2) the DR round took place during a no-teaching week at the BUE, referred to at the BUE as the revision week.[16] When we sent the e-mails to subjects to re-visit the lab for the

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16. That also was the week preceding the examination period.

DR round, we used the term "revision week" not to have any mention of Ramadan. Both (1) and (2) were meant by the authors to minimize any potential experimenter demand effect resulting from subjects relating the timing of the second round with Ramadan. Table 1 displays the average characteristics of subjects who showed up for both rounds, and who did not show up for the DR round. Most of the students (93%) in the BR did not show up for the DR, which can be explained by (2) above, and which resulted in higher representation of administrative and blue-collar workers in the sample in the DR round. This is also reflected on the age distribution between the DR shows and no shows with more middle aged and less younger subjects.

Table 1 – Mean Subjects' Characteristics by Attrition

	Shows to Both Rounds (N=121)	No Shows to DR (N=48)	Diff.
Job			
Academic	0.16	0.25	-0.093
	[0.37]	[0.44]	(0.160)
Administrative	0.63	0.42	0.211*
	[0.49]	[0.50]	(0.013)
Blue-Collar	0.20	0.02	0.178**
	[0.40]	[0.14]	(0.004)
Student	0.01	0.29	-0.283**
	[0.09]	[0.46]	(0.000)
Age			
Less than 30 y/o	0.39	0.67	-0.278**
	[0.49]	[0.48]	(0.001)
30 to 39 y/o	0.46	0.27	0.192*
	[0.50]	[0.45]	(0.022)
40 to 49 y/o	0.10	0.02	0.078
	[0.30]	[0.14]	(0.086)
50 y/o or more	0.04	0.02	0.020
	[0.20]	[0.14]	(0.518)
Female	0.45	0.34	0.110
	[0.50]	[0.48]	(0.198)

Standard deviation in brackets. Wilcoxon-Mann-Whitney test p-values in parentheses.
** p-value < 0.05, * p-value < 0.10.

The attrition is not correlated with the composition of the two groups as there are no significant differences in observables across both groups in both rounds, except that the EF group in the DR round has more individuals in the 30 to 39 years old, and fewer individuals in the 50 years old or more, age brackets (See Appendix Table C1).

Of the participants who showed up for both rounds, 96% are Muslims with no significant differences in religious composition across HF and EF (according to a Mann-Whitney test). We cannot determine attrition by religious affiliation because we only ask the religion-related questions in the DR round. The majority of Muslims (93.4%) were fasting during the DR round of the experiment. The percentages of fasting Muslims in the HF and EF groups are insignificantly different according to a Mann-Whitney test.

4.2 Dishonesty and Real Effort Measurement

4.2.1 Dishonesty

In our context, a subject is dishonest when reporting a number higher than drawn to get a higher payout. [17] Out of the 169 subjects who took part in the BR round, 11 (6.5%) lied. While this is a small percentage, it is not at odds with the literature given that the majority (90%) of our experimental subjects are non-students. For example, in Abeler, Becker and Falk (2014)'s coin flipping game, the reported flips by non-student subjects were not significantly different than the (50%-tails) theoretical distribution. Furthermore, Djawadi and Fahr (2015) found that students lie significantly more than non-students do. In our study, 13.33% of the students subjects lied in comparison to 5.92% of the employees, yet the difference is not statistically significant. There is also no statistically significant difference in attrition by liars (8.33% among the no-shows, compared to 5.79% among the shows; Fisher's exact p-value = 0.38).

Second, we restrict the sample to only subjects who re-visited the lab for the DR round and compare their behavior in both rounds. As shown in Figure 1, in the BR round, lying is slightly higher in the HF group (7%) than in the EF group (4%). In the DR round, the percentage of liars in the HF remains unchanged at 7%. However, the EF group witnessed a significant jump in dishonesty during Ramadan (16%) compared to before Ramadan (4%). This is an intriguing observation that we will analyze further in the next sections. [18]

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17. The terms dishonesty and lying are used interchangeably.

18. Although we observe the lie size, we prefer using the lying decision as dichotomous (i.e., lying versus truth-telling) due to the low percentage of liars (see Appendix Figure C1). However, we present a replication of our analysis using the lie size in Appendix E.
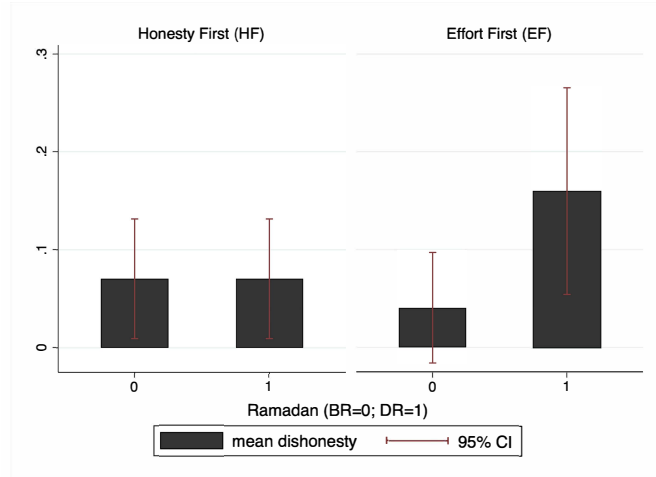
Figure 1 – Mean Dishonesty by Group and Round
(N = 121)

4.2.2 Real Effort

In the real effort task (RET), we look at the number of attempted as well as the number of accurately accomplished (i.e. letters found correctly) tasks. We define RET success as the percentage of accurately accomplished tasks out of the attempted tasks. Our data shows no significant differences in RET success by attrition or by group (see Appendix Table C2).[19]

RET success and dishonesty have a correlation coefficient of -0.09 in the BR round, and -0.03 in the DR. There are no significant differences in RET success between the liars and non-liars in both rounds and both groups.

5 Empirical Analysis

In what follows, we restrict our analysis to the sample of individuals who showed up to both rounds.

5.1 Specification

First, we exploit the cross-sectional variation in dishonesty across the HF and EF groups in the BR round to test for the baseline effect of effort on dishonesty. We run the

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19. The EF group significantly attempted more tasks in both rounds than the HF group, however, the RET success rate is not significantly different across the two groups in the two rounds as shown in Appendix Table C2.

following regression equation:

$$Lie_i = \alpha_1 + \alpha_2 EF_i + X^T \alpha_3 + \epsilon_i \tag{1}$$

where Lie_i is a dummy variable that is equal to one if individual i reported a number higher than drawn and zero otherwise. EF_i is a dummy variable that equals one if the subject is in the EF group. X is a vector of control variables including gender, age group, and job type (i.e. academic, administrative, blue-collar, student), where the reference categories are male, less than 30 years old and academic, respectively. We also control for the draw of the highest payoff maximizing number (six) to account for the lack of motivation to lie.

Second, we do a panel data analysis for the two rounds to test for the change in dishonesty in Ramadan relative to before Ramadan. Specifically, we estimate the following equation using the Linear Probability Model (LPM):

$$Lie_{it} = \gamma_i + Ramadan_t + \beta_1(EF_i * Ramadan_t) + \beta_2 Six_{it} + u_{it}$$

where Lie_{it} is a dummy variable that equals one if individual i lied in round t, γ_i is a full set of individual time-invariant characteristics including being in the EF/HF group, and $Ramadan_t$ is a dummy variable that is equal to one in the DR round, and zero otherwise. We control for if individual i drew a six (the payoff maximizing number) in round t as mentioned above.

5.2   Findings

The cross-section results are presented in Table 2. While we fail to detect a statistically significant effect of effort on lying, the coefficient shows a negative sign in all specifications. This suggests that the real effort may have a negative rather than a positive initial effect on dishonesty as suggested by the knowledge structure model of self-control. Alternatively, the subjects in the EF group may have witnessed some endowment or wealth effects due to the participation in the RET before the honesty game.[20] Either way, the result is statistically insignificant.

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20. Recall that endowment or wealth effects are expected to be low by design.

Table 2 – Cross-section Analysis of Dishonesty in the BR Round
(Dependent Variable: Lie_i)

	(1)	(2)	(3)	(4)	(5)
EF	-0.030	-0.032	-0.040	-0.038	-0.033
	(0.041)	(0.042)	(0.042)	(0.042)	(0.042)
Female		-0.006	-0.007	0.002	0.002
		(0.043)	(0.046)	(0.047)	(0.047)
30 y/o to 39 y/o			0.033	0.033	0.031
			(0.042)	(0.043)	(0.043)
40 y/o to 49 y/o			0.036	0.046	0.044
			(0.089)	(0.096)	(0.096)
50 y/o or more			-0.062*	-0.044	-0.055
			(0.035)	(0.040)	(0.042)
Administrative				0.076**	0.069**
				(0.032)	(0.031)
Blue-Collar				0.033	0.029
				(0.049)	(0.049)
Student				-0.001	-0.016
				(0.034)	(0.036)
Six					-0.060**
					(0.025)
Constant	0.070**	0.074**	0.062*	0.001	0.016
	(0.031)	(0.033)	(0.035)	(0.034)	(0.036)
N	121	120	120	120	120
Adjusted R^2	-0.004	-0.013	-0.030	-0.041	-0.041

OLS regression. Robust standard errors in parentheses. Dependent variable is a dummy that takes the value of one if lied, zero otherwise. Omitted categories are males, less than 30 years old, and academic. The correlation coefficient between age and job type is -0.116.
Note: This table is replicated using *LieSize* as a dependent variable in Appendix Table E1. *LieSize* is an integer that varies from 0 to 5. Similar to the results on this table, there is no significant effect for the EF on the lie size.
* p-value < 0.10, ** p-value < 0.05.

Finding 1: There is no evidence in support of the EF group having higher or lower mean dishonesty than the HF group in the BR round due to statistical insignificance. However, the direction of the relationship seems to be more likely negative than positive.

Furthermore, observed individual characteristics do not seem to be correlated with the probability of lying, except for the administrative employees who are more likely to lie than academic staff. [21] In addition, as one may intuitively expect, the draw of the highest paying number (*six*) significantly decreases the probability of lying.

Second, we trace the decisions for dishonesty for every subject over the two rounds

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21. The 50 years old or more age group are slightly less likely to lie than below 30 years old individuals in one specification. However, the significance is not robust to adding additional controls.

through panel analysis. Table 3 presents the panel regression results using Fixed Effects (column 1) and Random Effects (columns 2 and 3) models. Although the results are similar, the RE model is more efficient (Hausman p-value = 1.00). Within the HF group, we find no effect of fasting on the probability of lying between the two rounds as shown by a relatively small and insignificant coefficient of *Ramadan*. This means that the opposing religiosity and physiological or psychological effects of Ramadan may have cancelled out leading to no effect for fasting on dishonesty. [22]

Finding 2: We find no change in dishonesty among the HF group during Ramadan (DR) compared to before Ramadan (BR).

Table 3 – Panel Data Analysis of Dishonesty: Fixed Effects vs. Random Effects (Dependent Variable: Lie_{it})

	(1) FE	(2) RE	(3) RE
EF		-0.030	-0.023
		(0.051)	(0.053)
Ramadan	0.000	0.000	0.005
	(0.033)	(0.033)	(0.033)
Ramadan X EF	0.120**	0.120**	0.120**
	(0.052)	(0.052)	(0.051)
Controls	No	No	Yes
Individual FE	Yes	No	No
N	242	242	240
Overall R^2	0.02	0.02	0.07

Panel regression. Hausman p-value = 1.00; suggesting that the RE is more efficient. Dependent variable is a dummy that takes the value of one if lied, zero otherwise. Controls include the draw of six, gender, age group and job dummies. Omitted categories are males, less than 30 years old, and academic.
Note: This table is replicated using *LieSize* as a dependent variable, where it varies from 0 to 5, in Table E2. Similar to the results on this table, being in the EF group in Ramadan increased the lie size.
* p-value < 0.10, ** p-value < 0.05.

On the other hand, we find a significant positive effect on the probability of lying among the EF group during Ramadan compared to before Ramadan. This means that the effort-induced fatigue has a stronger effect on dishonesty during than before Ramadan. This positive effect is captured by the summation of the Ramadan coefficient and the coefficient of the interaction term (*Ramadan * EF*) in Table 3. Therefore, our third finding is:

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22. We discuss potential mechanisms in the following section.

Finding 3: Effort increases lying in Ramadan. This is demonstrated by an increase in lying by the EF group during Ramadan (DR) compared to before Ramadan (BR).

Finally, we look at the change in relative dishonesty across the two groups in the two rounds (i.e. the difference-in-differences). We find that the effort-induced fatigue augments the Ramadan physiological and/or psychological effects leading to a significant (difference-in-differences) increase in the probability of lying by 12 percentage points. This is shown by a positive and significant coefficient of the interaction term ($Ramadan *$ EF) in Table 3. This result is stable whether we use a fixed-effects (FE), in column 1, or a random-effects (RE) models, in columns 2 and 3, and whether or not we control for individual (time-invariant) demographics in an RE model (columns 2 and 3). Thus:

Finding 4: Evidence shows that the overall change in relative dishonesty between the EF and HF groups during Ramadan (DR) compared to before Ramadan (BR) is positive.

It is worth noting that all the above findings hold when using the lie size, an integer that varies from 0 to 5, as an outcome (Tables E1 and E2). In the following section, we discuss potential mechanisms through which the combined effect of fasting and effort has resulted in higher levels of dishonesty for the EF group relative to the HF group.

6   Mechanisms

The experimental design we use in this paper does not allow us to empirically identify the mechanisms that are driving our results. However, we employ the post-experiment questionnaire responses to provide suggestive evidence on some of the potential mechanisms, which we discuss in this section.[23]

6.1   Fasting-Induced Religiosity

We measure fasting-induced religiosity, as a potential mechanism of our findings, by the individual observance of *Tarawih*, a Ramadan-specific prayer. This is a non-obligatory prayer that takes place in the evening after breakfasting (*iftar*) and consists of reading

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23. In this section, we analyze the mechanisms driving the lying decision, and in Appendix E we replicate the analysis with respect to the lie size. In both analyses, we restrict the sample to fasting individuals. We provide summary statistics for the mechanisms variables in Appendix Table C3.

extracts from Qur'an in 8 to 20 *rak'at*.[24] While 93.39% of our sample were fasting during Ramadan, only 54.31% reported that they regularly observed *Tarawih*.[25] We also use *Fajr* prayer, as an alternative measure of religiosity. *Fajr* is the first prayer during the day that is due at dawn, which makes it a costly religious observance. *Fajr* is reported to be regularly observed by only 23.5% of our sample.[26] We prefer *Tarawih* and *Fajr* to fasting as measures of adhering to Ramadan directives, because of two reasons: (1) they provide higher variability in the sample, and (2) they are less susceptible to peer pressure in the working place than fasting, as they are both due outside the working hours, unlike fasting.

Our data does not provide supportive evidence that the combined effect of fasting and effort varies between *Tarawih-praying* and *non-Tarawih-praying*, or between *Fajr-praying* and *non-Fajr-praying*, subjects (Appendix Table D1). We thus fail to find evidence that fasting-induced religiosity explains the significant increase in dishonesty among the EF subjects during Ramadan, relative to the HF group.

6.2 Alimentary Abstention

Fasting during Ramadan entails complete alimentary abstention from dawn to dusk on every day. The questionnaire enables us to observe whether fasting subjects had their last meal during the evening before the experiment day (high alimentary abstention), or right before dawn on the experiment day (low alimentary abstention). High-abstention individuals amount to 30.58% of our fasting subjects with no significant difference across the HF and the EF groups (χ^2 p-value = 0.332). We expect high alimentary abstention to augment the fatigue caused by the RET, leading to higher dishonesty among the EF group in Ramadan. However, we fail to find evidence that the combined effect of fasting and effort on honesty varies by alimentary abstention (see Appendix Table D2).

We also employ subject's nutritional habits outside Ramadan, as a second measure of alimentary abstention. Specifically, we classify subjects into caffeine-dependent (59.5%) and non-caffeine-dependent subjects, based on the questionnaire.[27] As with our first

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24. *Rak'at* is a set of prayer movements dictated by Islam. Source:
https://muslimhands.org.uk/latest/2021/04/instructions-for-performing-tarawih-in-ramadan
25. *Tarawih*-praying subjects amount to 58.8% of the HF group, compared to 47.9% of the EF group (χ^2 p-value = 0.10).
26. This percentage is significantly higher in the HF group (28.4%) than in the EF group (16.7%).
27. A recent study found that 98% of a sample of university employees in Egypt are caffeine-dependent.

measure of alimentary abstention, we fail to find evidence that the combined effect of fasting and effort varies by caffeine dependency (Appendix Table D2).[28] Consequently, we are not able to find supportive evidence that alimentary abstention is a mechanism that is driving the rise in dishonesty among the EF group in Ramadan.

6.3   Self-Control Exertion

A third mechanism that may be driving the differential increase in dishonesty within the EF group in Ramadan could be the after-effect of self-control exertion during the effort task. While the literature has documented a change in behavior following the exercise of self-control in the short-run, the mechanism of this change is highly debatable. One direction accrues this change to "ego depletion" as defined by the "resource" model of self-control due to Baumeister et al. (1998). According to this model, the exertion of self-control in an initial task depletes the individual's self-control reserve in the short run impairing their ability to control oneself in a subsequent task. The resource model has recently come under strong criticism, as replicability studies raised doubts on the effect sizes of ego depletion.[29] In contrast, the "process" model of self-control interprets the change in behavior as an increase in reward-seeking tendencies following the exertion of self-control (Inzlicht and Schmeichel, 2012; Kelley, Finely and Schmeichel, 2019). According to this model, self-control is an "evasive" activity, and so there happens a shift in motivation in its aftermath intensifying reward-seeking tendencies.

Does self-control exertion explain our findings? We first note that the null effects of effort in the absence of fasting, and of fasting in the absence of effort, do not support either the *resource* or the *process* models of self-control, as self-control exertion in a single task (RET or fasting) did not impair the self-control ability in the subsequent task or lead to higher reward-seeking tendencies. Hence, for either model to be a valid mechanism, self-control exertion has to happen in a *bundle* of tasks.

For the resource model, Palma et al. (2018) provide a theoretical foundation, supported by empirical findings, of a "threshold" of self-control exertion beyond which ego depletion occurs. In our experimental design, we can interpret combining fasting and

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The study also discussed that caffeine withdrawal negatively affects the overall individual fitness, concentration, and mood state (Tayel, Abo-Rhyem, and Tawfik, 2018).

28. The results on religiosity and alimentary abstention both hold when using the lie size as an outcome in Appendix Tables E3.1 and E3.2, respectively.

29. The debate around ego depletion is presented in the Related Literature section in more details.

effort as potentially achieving this threshold. We are not able, however, to confirm or reject the process model, as an alternative mechanism that may be driving our results. For one, while it is plausible to apply the notion of "threshold" to reward-seeking tendency, there is no evidence in the literature to date to support this argument. For another, testing this mechanism requires that the second task facing the treatment group (EF in our design) is not self-control demanding (Kelley, Finely and Schmeichel, 2019), which is not the case in our design as the honesty game requires self-control.[30] Therefore, in what follows we focus on Palma et al. (2018)'s ego depletion threshold, but we acknowledge that we are not able to examine the reward-seeking hypothesis.

To examine the ego depletion mechanism, we employ two alternative measures to proxy for ego depletion. First, following Palma et al. (2018), we use the compliance with the RET, or the success rate in RET, as a measure of self-control depletion.[31] Our findings reveal that high compliers in the EF group experienced a significant increase in their lying behavior during Ramadan, whereas low compliers did not experience a change in dishonesty (Appendix Table D3). This suggests that ego depletion is a plausible mechanism of our finding, where high compliance with the RET may have acted as an additional ego depletion trigger, together with fasting, that increased lying.

Our second measure of ego depletion is smoking, since smokers may have a lower initial reserve of self-control, or may be more vulnerable to ego depletion due to the prohibition on smoking during Ramadan.[32] We thus examine whether smokers in our sample are driving the rise in dishonesty among the EF group during Ramadan.[33] We find that the increase in lying among the EF group during Ramadan is larger among smokers (Appendix Table D3). This result is similar, in terms of magnitude and significance, to that on the high compliers with the RET measure.[34] Furthermore, we find that high

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30. While it is possible to test the reward-seeking hypothesis among the HF group, this would imply examining compliance with RET as the main outcome, which lies outside the scope of this article.

31. We define high compliance by a dummy variable that takes the value of one if the success rate is above the median. The success rate in RET is 87.11%, on average. The median success rate is 90.32% before Ramadan, and 93.10% during Ramadan.

32. Previous studies indicate that smokers are indeed more vulnerable to ego depletion. Smokers develop a habit to consume cigarettes on a regular basis (Kan, 2007). Smokers may also increase their cigarette consumption when following a restricted dieting plan (Cheskin et al., 2005; Hall et al., 1992). Shmueli and Prochaska (2009) demonstrate that dietary restrictions, together with restrictions on smoking, quickly deplete smokers' self-control ability leading to more smoking once the restrictions are lifted. They interpret their empirical results in terms of the resource model of self-control.

33. In our sample, 31.4% are smokers, and this percentage is slightly higher in the EF group than in the HF group (38% versus 27%, respectively; χ^2 p-value = 0.064).

34. The correlation coefficient between the two measures is low, however, at -0.05.

RET compliers and smokers not only drive the combined effect of effort and fasting on the probability of lying but also on the magnitude of the lie size (see Appendix Table E3.3). Accordingly, our suggestive evidence lends support to ego depletion as a plausible mechanism. [35]

6.4 Other Mechanisms

There are other mechanisms that may explain the differential rise in dishonesty by the EF group during Ramadan. We discuss some of these mechanisms below.

Repetition. Our experimental design involves the repetition of the same tasks for the same subjects over two rounds. Repetition of the experiment in its own right should not result in a *differential* increase in dishonesty in the EF group, compared to the HF group. However, repetition of the real effort task may have caused anger or frustration for the subjects against the experimenter. This negative emotion may have driven the EF group to punish the experimenter by lying in the subsequent honesty game. The HF group, on the other hand, played the honesty game prior to the real effort, and therefore the option of punishing the experimenters was not given to them. [36]

To account for this potential mechanism, we control for subjects' impression on the RET. Specifically, we ask subjects in the BR round an open question about their opinion on the games. In our sample, 19.7% and 24% of the HF and EF groups, respectively, reported a negative impression on the effort task (Mann-Whitney p-value $= 0.43$).

We control for the negative impression variable in Appendix Table D4. We fail to detect that the negative impression on RET is driving the effect of fasting and effort on dishonesty. However, having a negative impression on the RET resulted in a bigger lie size for dishonest individuals in the EF group during Ramadan (Appendix Table E3.4).

Moral Licensing. Moral licensing suggests that the morality of an initial act can inversely affect the morality of a following act. [37] According to Blanken, van de Ven, and Zeelenberg (2015): "The idea of moral licensing theory is that the prior good deed provides a "license" that allows one to perform morally questionable behavior later on"

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35. This suggestive evidence is in line with Mead et al. (2009)'s findings that depletion increases cheating.

36. The authors thank Sven Höppner for suggesting this mechanism.

37. We thank an anonymous reviewer for suggesting this mechanim.

(Blanken, van de Ven, and Zeelenberg, 2015, p.540). Individuals are then expected to lie, or feel more entitled to, after engaging in a moral act, and vice versa (Jordan, Mullen, and Murnighan, 2011). We can therefore think of three possible "good deeds" in our design that may have resulted in moral licensing.

First, we may consider fasting as the "moral act" that could result in an increase in lying in the honesty game. To account for this possibility, we compare the lying behavior of the HF group before and during Ramadan, in order to isolate the two acts of fasting and honety. Since 95.77% of the HF group reported that they were fasting in Ramadan, we should expect a rise in dishonesty by the HF group in Ramadan, which is not the case.

Second, we may consider high compliance in the RET as the moral act that would result in higher lying in the honesty game. To account for this possibility, we compare the lying behavior of the RET high and low compliers, within the EF group before Ramadan, in order to isolate the two acts of effort and honesty. We should expect, in line with moral licensing, that high compliers are more likely to lie. However, we fail to detect any difference in lying between high- and low-compliers before Ramadan (p-value = 0.158).

That said, we acknowledge that moral licensing may be still driving our results in ways that we are not able to test with our data. For one, one may argue that honesty before Ramadan is the moral act that could have resulted in more dishonesty during Ramadan. However, we are not able to isolate the two subsequent acts of honesty, because the second round of the honesty game was played during Ramadan, which makes honesty confounded with fasting. For another, and perhaps more importantly, it is plausible that the act that is needed for moral licensing is not a single act, as we have assumed so far, but rather a "bundle" of acts. For example, the combination of effort and fasting for the EF group in Ramadan could provide moral licensing to the subject leading to more lying in Ramadan, whereas neither effort nor fasting is sufficient on its own.

To sum up, we examined some of the potential mechanisms that may be driving the negative effect of fasting and effort on honesty. While we are not able to find supportive evidence that religiosity, alimentary abstention, or repetition, may be driving our results, we find suggestive evidence in support of ego depletion. We are also not able to confirm or refute that moral licensing, feeling of entitlement and/or reward-seeking tendency, may

be driving the rise in dishonesty among the EF group in Ramadan. Furthermore, we remind the reader that our evidence is suggestive, mostly based on proxies observed in the post-experiment questionnaire, and hence examining the theories underlying these mechanisms lies outside the scope of this paper and requires further research.

7 Conclusion

This paper examined the effect of religious fasting, when augmented with exerting intensive effort, on honesty using a laboratory experiment in Egypt. Religious fasting can promote honesty due to fasting-induced religiosity, but it can alternatively reduce honesty due to its physiological and psychological implications that may arise from alimentary abstention and other restrictions, and these effects can be exacerbated when exerting effort. We employed a differences-in-difference strategy, where we traced individuals' honesty decisions before and during Ramadan, in the absence and presence of an unrelated real effort task. We found that real effort alone did not affect honesty before Ramadan, and that fasting alone, in the absence of real effort, did not affect honesty during Ramadan. However, we found that the exposure to both fasting and real effort reduced honesty. We employed the post-experiment survey questions to shed light on the mechanisms of this negative effect on honesty. While we fail to find supportive evidence that religiosity or alimentary abstention are driving our findings, our analysis points to ego depletion as a plausible driver of increased dishonesty when fasting is augmented with real effort. This finding demonstrates that the extensive use of self-control—in fasting and the real effort task—may impair subsequent decision-making ability. That said, we are not able to confirm or refute the rewards-seeking hypothesis and the moral licensing model as potential explanations of our findings.

Our findings therefore emphasize the importance of rationing effort exertion while fasting. By this we mean that, regardless of the motive and type of fasting, abstaining individuals should avoid excessive effort-intensive tasks that may impair their honesty. Recall that fasting individuals in our sample who did not exert additional effort did not experience an increase in lying behavior, although they exerted normal daily activities outside the laboratory.

This paper opens new and exciting areas for research. One direction for future research

could be what incentives structure may moderate the negative effects of effort exertion in the workplace. The real effort task in our setup deliberately involved little financial gain, in order to cause frustration among subjects. The question then arises as to the optimal incentive structure that can mitigate the negative effect of effort exertion while fasting. Another direction of research is to design experiments that would enable us to formally test some of the models that underly our mechanisms. These include, most importantly, the rewards-seeking hypothesis and the moral licensing model.

Acknowledgements

Data Availability Statement

The data that support the findings of this study are openly available in openICPSR at https://doi.org/10.3886/E196162V2, reference number openicpsr-196162.

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